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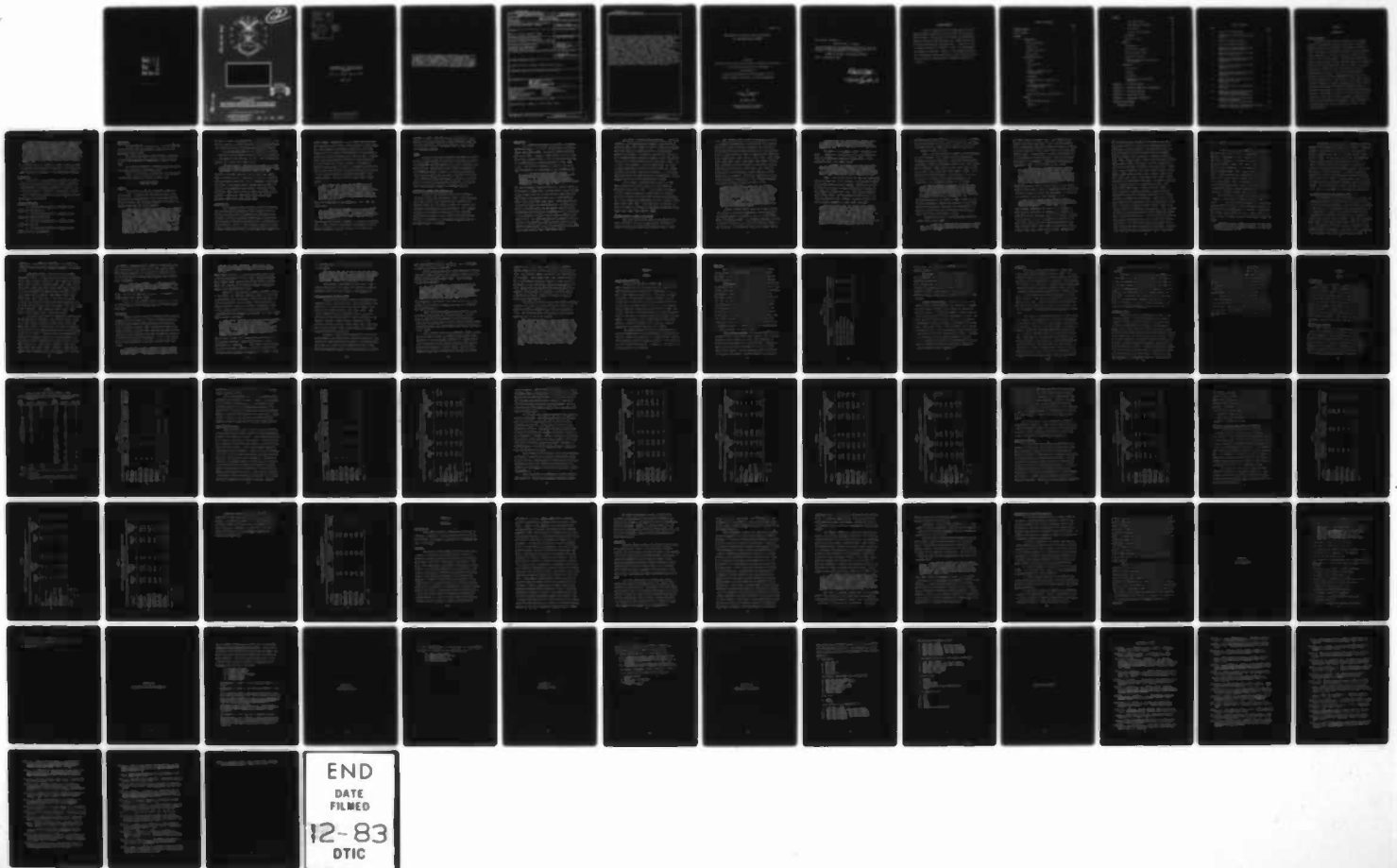
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WRIGHT-PATTERSON AFB OH SCHOOL OF SYST.. R J VAUGHN
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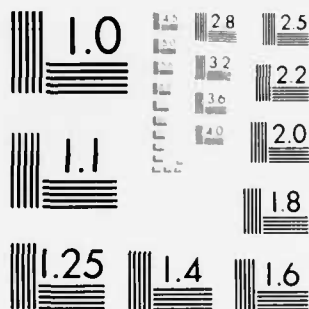
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THE EFFECTS OF A QUALITY CIRCLE
INTERVENTION ON FOUR BEHAVIORAL
OUTCOMES

Robert J. Vaughn, Captain, USAF

LSSR 14-83

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Quality Circles are currently receiving significant attention in both civilian industry and the Department of Defense. Their potential benefit as a management tool has rapidly spread throughout this country's managerial echelons as a result of numerous QC success stories. However, a glaring absence of empirical evidence on the QC phenomenon is preventing its acceptance as a proven management tool. This thesis, using a nonequivalent control group design, assessed the effects of a QC intervention on four behavioral outcomes--job satisfaction, work group performance, job effort, and intent to quit/remain. The study's participants represented two separate USAF installations and were all volunteers. A portion of the subjects at each installation received QC training prior to the QC intervention in their respective organizations. The remaining group of subjects comprised the control group. The results indicated QC participation had no significant effect on the outcomes studied; however, numerous recommendations for implementing and evaluating future QC interventions are identified.

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THE EFFECTS OF A QUALITY CIRCLE INTERVENTION
ON FOUR BEHAVIORAL OUTCOMES

A Thesis

Presented to the Faculty of the School of Systems and Logistics
of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the Requirement for the
Degree of Master of Science in Systems Management

By

Robert J. Vaughn, BS
Captain, USAF

September 1983

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This thesis, written by

Captain Robert J. Vaughn

has been accepted by the undersigned on behalf of the faculty of the School of Systems and Logistics in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE IN SYSTEMS MANAGEMENT

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COMMITTEE CHAIRMAN


READER

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CHAPTER 1

INTRODUCTION

Problem Statement

Quality Circles and their apparent role in Japan's industrial success have aroused the interest of American industry and have even impacted the Department of Defense (DOD). Estimates of the number of Quality Circles operating in the DOD indicate as many as 1,000 may currently exist (Steel, Ovalle, & Lloyd, 1982). Influenced by subjectively based success stories, numerous American managers now believe Quality Circles are the state-of-the-art method to increase productivity, product quality, and many other critical organizational criteria. Others have heard reports of miserable failures and have dismissed Quality Circles as another managerial fad. Unfortunately, very little research has been conducted on Quality Circles and not until recently (1981) has there been any published empirical efforts to determine their impact on various attitudinal and behavioral criteria. Fortunately, the DOD is on the frontier of this scientific effort and is led by a group of researchers at the Air Force Institute of Technology. Their philosophy in conducting Quality Circle research is reflected in the following quote:

We could answer many of these [Quality Circle effect] questions by relying on anecdotal evidence, impressionistic reports, or personal testimonials. Information generated using scientific methods of data collection will allow us to draw conclusions about quality circles with more confidence than is possible with other sources of information. Research evidence is carefully collected so that the results observed may be attributed directly to the effects of the quality circles process rather than to alternative or confounding forces which occur concurrent with the study (Steel, Ovalle, Lloyd, & Hendrix, 1982, p. 42).

This research effort is intended to support that philosophy by a systematic and scientific evaluation of the effects of a Quality Circle intervention on four behavioral outcomes.

Objectives

Specifically, the research will analyze the effects of Quality Circle participation on self-report measures of Job Satisfaction, Work Group Performance, Job Effort, and Intent to Quit/Remain. The goal is to continue to build a scientific foundation on which the value of Quality Circles can accurately be assessed.

Research Questions

1. How does participation in a Quality Circle affect Job Satisfaction?
2. How does participation in a Quality Circle affect Work Group Performance?
3. How does participation in a Quality Circle affect Job Effort?
4. How does participation in a Quality Circle affect Intent to Quit/Remain?

Definitions

Job Satisfaction--a pleasurable or positive emotional state resulting from the appraisal of one's job or job experiences (Locke, 1976).

Work Group Performance--effectiveness at which two or more persons working interdependently perform a given task.

Job Effort--the amount of mental and physical activity a person expends in performing a task.

Intent to Quit/Remain--an employee's attitude which reflects their desire to voluntarily leave a job.

LITERATURE REVIEW

Purpose

This section reviews the literature on Quality Circles (QCs). Although minor differences exist in the various sources describing QCs (also called QCCs--Quality Control Circles), the following represents the general consensus concerning a QC and its purpose:

A QC circle is a relatively autonomous unit composed of a small group of workers (ideally about ten), usually led by a foreman or senior worker and organized in each work unit. Participants are taught elementary techniques of problem solving including statistical methods. It is in principle a voluntary study group that concentrates on solving job-related quality problems. These problems are broadly conceived as improving methods of production as part of company wide efforts At the same time, the circles focus on improving working conditions and the self-development of workers Above all, the circles involve recognition that hourly workers have an important contribution to make to the organization (Cole, 1980, p. 24).

The role of the QC has expanded beyond dealing strictly with quality problems, as identified above or as the name implies. In a recent QC article, Dailey and Kagerer (1982) stated, ". . . the problems addressed are not restricted to quality but may be in any area that influences, directly or indirectly, the output of the work unit" (p. 40). World renowned QC theorist Dr. Joseph Juran (1980) states:

The main effect of the QC Circle movement is utilization of the education, experience, and creativity of the work force to aid in improving company performance. This improvement is not restricted to quality (p. 22).

As Juran's statement indicates, QCs are more than product quality problem solvers. Throughout the current literature they are viewed as potential tools to implement a management philosophy; a philosophy geared towards improving usage of industry's most underutilized resource, the hourly worker (Alexander, 1981; Blair & Hurwitz, 1981; Cole, 1980; Dailey & Kagerer, 1982; Hunt, 1981; Ingle, 1982; Juran, 1980; Kanarick, 1981; Klein, 1981; Rehg, 1976).

Justification

The increasing competitiveness in both the national and international environment dictates the need for more effective utilization of an organization's resources, particularly its people. Research showed that in annual percentage change in manufacturing productivity, as measured in output per hour, the U.S. (2.6% increase) ranked last among 11 major industrialized countries from 1960-1979 (Capdevielle

& Neef, 1980). Interesting to note, Japan (9.2% increase) was identified as the leader. More recently, in 1980, Japan had a 10% increase in automobile productivity over 1979, whereas the U.S. witnessed a 30% decrease in its automobile productivity from the previous year (Samiee, 1982). Combine these facts with Honeywell's Director of Human Resources, Dr. Arnold Kanarick's (1981) statement, "Contemporary American workers aspire not only to an improved worklife but also to more jobs offering a personal sense of participation" (p. 16), and the dilemma facing American managers today becomes evident. Harvard professor, Robert Hayes (1981) states:

As a result, U.S. plant and equipment have been allowed to age. Our technological advantage has eroded. . . . This complacent attitude toward the problem of production did not impair the competitiveness of U.S. manufacturers for a number of years--until, that is, they began to encounter companies (like those in Japan) that did compete on such mundane grounds as reliable, low cost, defective-free products and dependable delivery (p. 65).

Even more convincing are the comments by Juran (1981) who states that:

. . . most Western managers have not fully grasped the seriousness and the immediacy of the threats [of foreign quality competition]. In addition, I believe that most Western managers are seriously underestimating the time required for a successful response to meet these threats (p. 7).

The credibility of Juran's statement is enhanced considering that in 1967 he wrote, "The Japanese are headed for World Quality leadership, and will attain it in the next two

decades" (p. 336). The time for America to solve its productivity and quality problems is now. Thorough investigation and evaluation of a potential solution, such as QCs, is a necessary process.

Scope

Articles on QCs were reviewed to determine the effect of QCs on organizations. Periodicals, as the primary source of information, provided insight into the past, present, and future of QCs. The periodicals most highly recognized in the management field, in addition to specific QC publications, were the source for the review. Because of the subject's relative infancy, particularly in the U.S., and the desire to obtain the most current information, the literature review primarily focused on 1974-1982 material.

Method of Treatment and Organization

Initially, the literature review will present a historical look at the development of QCs. After examining the history of QCs, their applications in American and Japanese firms will be analyzed in light of cultural, environmental, and managerial style differences. Key elements required for successful QC programs are then examined, followed by an analysis of the results of QC applications. Finally, an assessment of the research conducted thus far on QC effectiveness is provided.

Background

All literature providing QC historical information identified Japan as its origin. Influenced by historical events, particularly WWII, the Japanese began developing QCs in the 1950s to improve product quality "so as to earn the foreign exchange needed to buy the materials essential to an upward spiral of industrialization" (Juran, 1980, p. 19). The scientific methods on which QCs were based came from America, as illustrated in the following quote:

. . . in the early postwar [WWII] period . . . , the Japanese were willing to make the assumption that American management techniques must be the most advanced These developments were part of a "management boom" during which American management formulas and techniques were introduced into all spheres of business . . . (Cole, 1980, p. 24).

Dr. William Deming, teaching statistical quality control in 1950, and Dr. Joseph Juran, teaching quality control methodology in 1954, were the two most prominent Americans contributing to the Japanese effort (Cole, 1980; Davidson, 1982; Juran, 1967, 1981; Rehg, 1976). Deming was such an influential figure that the Deming Prize (an annual award given to the firm exhibiting the highest quality control standards) "was established to commemorate [his] contribution to the diffusion of quality control ideas in Japan" (Cole, 1980, p. 24). Dr. Iaioru Ishikawa and the Japanese Union of Scientists and Engineers (JUSE) are recognized as the key Japanese leaders behind the initial QC movement (Cole, 1980; Juran, 1967; Patchin, 1981, 1982; Rehg, 1976).

The number of QCs has grown dramatically since their inception. The JUSE reports the number of registered QCs increased from 1,000 in 1964 to 87,000 in 1978 and estimates place the number of unregistered QCs at an additional 435,000 (Cole, 1980). In America, starting with the first QC at Lockheed Missile and Space Company in 1974, the number in the U.S. is now estimated at over 3,000 (Metz, 1981). As a result of this growth, a new QC organization, the International Association of Quality Circles (IAQC), was formed in 1978 by two former employees of Lockheed. In its August 1982 publication, the IAQC estimates its membership at 5,000 members and over 50 local chapters (Riley, 1982).

A key element in analyzing QCs' history is that Japan adapted the concepts of QCs to fit the Japanese management style (Cole, 1980). It was during this adaptation that Japanese industrial leaders made the profound decision to ensure that each worker received exposure/training to the concepts and methodology of quality control (Cole, 1980; Juran, 1967, 1981). This decision is recognized as the key to Japan's successful QC management philosophy (Cole, 1980; Juran, 1980, 1981; Karatsu, 1982).

QC Applications in America and Japan

Many articles discussed American and Japanese cultural differences and their impact on QCs. Although not viewed as limiting QC application (Hatvany & Pucik, 1981;

Ingle, 1982; Karatsu, 1982), there are significant factors U.S. managers must consider in applying QCs. One cultural difference commonly identified throughout the literature was the American worker's individualism versus the Japanese worker's team-oriented attitude or organizational commitment (Cole, 1980; Deming, 1980; Jaeger & Ouchi, 1978; Juran, 1967, 1981; Klein, 1981; Moran, 1979; Rehg, 1976; Samiee, 1982). This commitment, derived from Japan's traditional lifetime employment practices (Cole, 1980; Hayes, 1981; Jaeger & Ouchi, 1978), has fostered the Japanese approach to QCs (which rely on teamwork). The need to understand this cultural difference is highlighted in the following statement by Stanford professors Johnson and Ouchi (1974):

For those who want to understand the Japanese approach--even more so for those who want to employ Japanese techniques in U.S. companies--it is essential to recognize the widely differing assumptions on which behavior in the two cultures is based. These differences are especially pronounced in the Japanese and American attitudes toward individuality and self-sufficiency. . . . [The Japanese worker] sees himself far less as an individual than he does a part of his family or work group. . . . The American system . . . rests on the underpinnings of a frontier society that exalted individualism (p. 68-69).

Another cultural aspect affecting QC application is that Japan is a relatively homogeneous culture compared to the diverse mixture of cultures in the U.S. (Juran, 1981; Rehg, 1976; Samiee, 1982). In describing application of QCs in America, Director of the Center for Japanese Studies at the University of Michigan, Dr. Robert Cole (1980) states:

I maintain that this [homogeneous cultural trait] is a profound point critical to understanding the willingness of Japanese employers to invest in the training of and provide responsibility for blue collar workers (p. 25).

The lesson to be learned is that, "the adoption of QCs . . . should fit cultural realities of the country in which the organization operates" (Mento, 1982, p. 82).

Supporting this, Cole (1980) states:

. . . a number of Japanese firms with established and successful QC circle programs in Japan have not pushed for their adoption in their U.S. subsidiaries. . . . [One Japanese manager in America] doubted whether American employees had sufficient organizational commitment to make the QC concept work in America (p. 28).

Japan's poor economy during the 1950s was undoubtedly the most significant factor external to the Japanese organization that enhanced the QC movement. Throughout the literature, the historical evidence establishes this fact as the impetus for Japan's QCs (Cole, 1980; Dailey & Kagerer, 1982; Juran, 1980). The QC movement in the U.S. will not have the luxury of such a dramatic national influence, as the following statement by Juran (1980) indicates:

During the 1970s, the U.S. economy has included a number of national problems which are in some degree related to product quality: unemployment, job insecurity, slow growth in productivity, price competition, consumer dissatisfaction. None of these problems is as closely correlated with product quality as was the Japanese export problem of the 1950s and early 1960s. Such being the case, I see no likelihood that any of these national problems (or even all of them collectively) will by their very existence supply the priorities needed for a QC Circle movement in the U.S. (p. 19).

Professor Gerald Klein (1981) also felt the "need to increase quality and productivity will lack the credibility and impact on workers and their unions that is needed to gain their . . . support for QCs" (p. 13).

Today, the most influential external factor affecting QCs are the unions. Their impact on QCs is documented throughout the entire spectrum of journalism from newspaper (Gottschalk, 1980) to professional journal (Cole, 1980, 1982; Dailey & Kagerer, 1982; Hatvany & Pucik, 1981; Ingle, 1982; Juran, 1980; Klein, 1981; Metz, 1981; Samiee, 1982). It is important for today's manager to be sensitive to the role of unions in the QC process in Japan and America, as reflected in the following statement by Cole (1967):

In Japanese manufacturing firms, the unions have usually been consulted by management at the time the circles were set up but the unions have not had much to do with the day-to-day operations of the circles. . . . the Japanese unions have not been much involved in circle activities. . . . in the U.S. . . . this does not appear to be a feasible strategy (p. 167).

The major concerns of the unions in regard to QCs are lack of union involvement, reduced job security for the workers, reward distribution not associated with improvements, job speed ups, and disruption of worker/union relationships (Cole, 1982; Klein, 1981; Newell, 1982).

Supporting the need to not underestimate American unions, Juran states (1967):

. . . it must be recognized that the Japanese manager has, for the most part, retained the leadership of the work force, and [unlike America] has not lost it to the Union . . . (p. 333).

One study, based on telephone interviews (augmented by personal and group interviews) of 200 United Auto Worker (UAW) nonsupervisory employees, showed that American workers were more dedicated to their unions than to their employers (Samiee, 1982). Interestingly, this same study showed 70% of the respondents favored group work stations and worker participation in management. Supporting this philosophy, Owen Bieber (1982), Vice President of UAW, states:

. . . Many of us in the UAW have come to believe that with strong union involvement, quality circles will definitely serve the workers' best interests. . . . Now certain segments of management have come to realize that they will make better products and more profits if they develop and encourage their work force rather than trying to discourage workers' initiative. Quality circles are perhaps the most tangible manifestation of that changing belief (p. 6).

Reemphasizing the union's potential impact on QCs, Bieber (1982) further states, "There is widespread belief among UAW advocates of quality circles that management, if left alone, will eventually screw up these programs" (p. 6).

Just as the Japanese adapted Western ideas on quality control to develop the QC circle, so will the Americans have to adapt QC circles to fit the needs of American management . . . (Cole, 1980, p. 28).

This statement highlights the need for U.S. managers to understand the difference in management philosophies in Japan and the U.S. and their implications for QCs. Concern for the employee is noted throughout the literature as a significant characteristic of Japanese management (Cole, 1980; Hatvany & Pucik, 1981; Jaeger & Ouchi, 1978; Johnson & Ouchi, 1974; Moran, 1979; Samiee, 1982). Managers not

only express personal concern for the employee but they extend this interest to the job by allowing employees to participate in decision making. Although some of the literature referred to this as consultive decision making (Hatvany & Pucik, 1981), decision by consensus (Jaeger & Ouchi, 1978; Johnson & Ouchi, 1974) or decentralized decision making (Moran, 1979), the concept is widely recognized as positively influencing the worker and/or application of QCs (Blair, Cohen, & Hurwitz, 1981; Cole, 1980; Davidson, 1982; Deming, 1980; Johnson & Ouchi, 1974; Karatsu, 1982; Klein, 1981; Mento, 1982; Moran, 1979; Muhs, 1982; Samiee, 1982). Because of this management philosophy, the workers feel they are an integral part of the organization (Hayes, 1981; Moran, 1979; Rehg, 1981). Hatvany and Pucik (1981), in their research on Japanese management, support Steers' finding that feelings of personal importance are strongly related to organizational commitment. They maintain that high organizational commitment leads to reductions in turnover. They cite findings by Porter, Steers, Mowday, and Boulian (1974) to substantiate this position. Also, evidence provided by Salancik and Pfeffer (1978) linked high commitment to high job satisfaction. Porter and Steers (1973) further found job satisfaction to have a significant impact on absenteeism. Dr. Mento (1982) feels that worker involvement, particularly participative decision making, increases both satisfaction and job performance and Dr. Rehg (1981)

cites job satisfaction as a direct benefit of QC participation.

In contrast to Japanese managers, American managers generally have a much different relationship with their employees. Management is more isolated (Cole, 1980; Hayes, 1981) and is primarily concerned with the product, not the employee (Johnson & Ouchi, 1974; Moran, 1979). As a result, there is little commitment to the organization on the part of the employee (Hayes, 1981; Jaeger & Ouchi, 1978; Samiee, 1982). Decision making has traditionally been individualistic and not participative (Gibson, 1981; Jaeger & Ouchi, 1978; Juran, 1980). "For the Westerner, a decision process based on consensus conveys a host of Parkinsonian horrors--interminable meetings, endless squabbling, and ultimate indecision" (Johnson & Ouchi, 1974, p. 66-67).

The lesson to be learned in highlighting these differences is illustrated by Hatvany and Pucik (1981) who state: ". . . the crucial change needed is in management's thinking about the nature of the relationship between the employee and the organization" (p. 477-478). Johnson and Ouchi (1974), Cole (1980) and Patchin (1980) support this idea, as does Kent State Professor Saeed Samiee (1982), who states:

Management must be committed to the long-term prosperity of its workers. Quality Circles . . . will be successful only if workers feel committed and dedicated to their employers (p. 91).

Another key difference between Japanese and American management philosophies is commitment to quality. Japanese managers' concern for product quality is identified in numerous sources (Cole, 1980; Juran, 1980; Karatsu, 1982; Patchin, 1981). As one would expect, this philosophy supports a program aimed at improved product quality. In America, quantity often takes precedence over quality. Because of the sometimes slow process inherent to QCs, this represents an obvious dichotomy. The need for American commitment to quality is expressed by prominent QC experts Deming (1980), Cole (1980), and Juran (1980, 1981), as well as other practicing QC experts, Alexander (1981) and Pagano (1982). As the literature revealed, commitment to quality is not the only requirement for successful QC application.

Key Elements Required for Successful QCs

Understanding the basic environmental, cultural, and managerial differences between America and Japan is important for the practicing manager. Given this basic knowledge, he may realize that QC implementation is not practical for his organization. Indeed, the literature indicated that "organizational readiness" to accept a QC is critical to their success (Blair, Cohen, & Hurwitz, 1981; Blair & Hurwitz, 1981; Gibson, 1982; Ingle, 1982; Klein, 1981; Metz, 1981). Also, the manager will realize the need to change the management/worker relationship to allow open lines of communication (Alexander, 1981; Ingle, 1982; Kanarick, 1981). In

addition to this background information, the literature suggests there are specific elements necessary for successful QCs.

Management support, both at the top and middle management levels, is identified as a key factor (Alexander, 1981; Bryant & Kearns, 1981; Cole, 1980; Comstock & Swartz, 1979; Sikes, Connell, & Donovan, 1980; Ingle, 1982; Juran, 1981; Metz, 1981; Rehg, 1976; Sprow, 1982; Yager, 1980) as is union involvement and support (Bryant & Kearns, 1981; Cole, 1980; Dailey & Kagerer, 1982; Hoban, 1982; Ingle, 1982; Klein, 1981; Metz, 1981). The need for adequate training for personnel associated with QC implementation is also identified as a key factor (Alexander, 1981; Cole, 1980; Dailey & Kagerer, 1982; Goodfellow, 1981; Ingle, 1982; Juran, 1978; Kacher & Soule, 1982; Rehg, 1976).

Voluntary participation is regarded as necessary for QC implementation (Alexander, 1981; Bryant & Kearns, 1981; Cole, 1980; Dailey and Kagerer, 1982; Ingle, 1982; Rehg, 1976; Yager, 1980). Interestingly, one article disagreed with the value of voluntary participation to the QC process (Sikes et al., 1980). Another aspect of QC implementation receiving considerable attention as a key ingredient for success is insuring recognition for positive results (Cole, 1980; Sikes et al., 1980; Dailey & Kagerer, 1982; Ingle, 1982; Rehg, 1976; Yager, 1980). Financial rewards for QC members were frequently mentioned throughout the literature.

Some authors recognized monetary reward as an important factor in QC success (Cole, 1980; Klein, 1981; Samiee, 1982). Mento (1982) regarded it as a potentially important factor. At the Norfolk Naval Shipyard, where QCs have been successfully implemented,

. . . most circle members . . . said that participation in the program, contact with top management, and resolving work-related problems were satisfaction enough without the need for financial incentives (Bryant & Kearns, 1981, p. 144).

Other articles also supported this policy of nonmonetary reward (Rehg, 1976; Sprow, 1982).

There are other elements which contribute to successful QCs; however, those described above are the most widely discussed.

QC Results

Numerous authors identified companies which achieved significant cost savings as a result of implementing QCs--\$52,000 at Westinghouse Defense and Electronics Systems Center (Comstock & Swartz, 1979), \$200,000 at Norfolk Naval Shipyard (Bryant & Kearns, 1981)--and Kanarick (1981) stated, "Quality Circles teams have resulted in estimated savings of several million dollars at Honeywell" (p. 16). The success has not been restricted to the U.S. as Juran (1980) indicates:

Over the last 16 years, these millions of workers have completed millions of projects to improve quality. The great majority would never have been made without the QC Circles. . . . The benefits to Japan and to the

Japanese have been formidable. Collectively, the millions of improvement projects have saved enormous sums of money, running into many billions of dollars (p. 18).

Organizations are also attributing nonmonetary gains such as reduced absenteeism (Patchin, 1981), improved employee morale (Hunt, 1981), improved motivation (Bryant & Kearns, 1981), and improved job satisfaction (Buback & Dutkewych, 1982) to the implementation of QCs.

There are a few reports of negative outcomes in the QC literature. Dr. Matthew Goodfellow (1981), in his study of 29 companies with QC programs, found only eight had successful QC programs. His statement, "While success has a thousand fathers, failure is an orphan" (Goodfellow, 1981, p. 71), perhaps explains the disproportionate amount of literature favoring successful QC programs. Dr. Klein (1981) made a similar observation:

Some current optimistic beliefs and perceptions about QC programs . . . can actually be harmful. . . . These perceptions have been strongly influenced by recent successful projects in this country and abroad. . . . Because it is the successful rather than the unsuccessful cases of employee participation that tend to be publicized . . . assumptions that are drawn from these cases about QC programs and workers in general are probably distorted (p. 15).

Hayes (1981), in his tour of manufacturing facilities of six Japanese companies, found quality circles "not as influential as I expected. . . . One company treated quality circles as secondary, peripheral activities; another had eliminated them altogether ["temporarily" it said]" (p. 58).

An even more startling observation is the following quote by Cole (1980):

The fact is that the circles do not work very well in many Japanese companies. Even in those plants recognized as having the best operating programs, management knows that perhaps only one-third of the circles are working well, with another third borderline and one-third simply making no contribution at all (p. 166).

This apparent controversy over the value of QCs is further justification for rigorous QC research in order to determine their true effectiveness on an organization.

Previous Research on QC Outcomes

Organizations which have reported nonmonetary gains (improved morale, job satisfaction, and/or performance) have generally not collected statistical data to support their observations (Bryant & Kearns, 1981; Hunt, 1981). This factor, combined with the recognized need to accurately determine QC effectiveness (Blair, Cohen, and Hurwitz, 1981; Donovan & Van Horn, 1980; Tortorich, Thompson, Orfan, Layfield, Dreyfus, & Kelley, 1981; Gibson, 1981, 1982; Hunt, 1981; Hurwitz & Sokol, 1982), has resulted in an emphasis towards professional evaluation.

Honeywell, using Pre-Post measurement with Control Group Designs, has obtained data reflecting significant cost reductions, improved machine utilization, and reduced learning curves as a result of QCs (Donovan & Van Horn, 1980). They found adequate measures, well-developed data collection,

and a good research design to be the key factors necessary to obtain an accurate evaluation.

General Dynamics has used a field observation design, injecting quality circles as the treatment variable into the regular work environment (Hunt, 1981). The following results were obtained:

. . . a 7:1 savings/cost ratio was projected from the results of the program and productivity in six circles was monitored in terms of reduced attrition, higher performance, improved quality, increased Employee Suggestions and specific projects. Less quantifiable, but equally impressive indications of better morale, tremendous team spirit, and more harmonious management/employee relations were present (1981, p. 111).

One recognized limitation of this study was the short time frame used to develop (4 months) and carry out (6 months) the research effort.

Martin Marietta Aerospace Michoud Division is conducting ongoing research on QC effectiveness. Initial results showed QC groups composed of hourly production employees had improved job attitudes, reduced accident rates, reduced grievance rates, and reduced defect rates (Tortorich et al., 1981).

The Air Force Institute of Technology (AFIT), as the DOD focal point for QCs, is presently evaluating QC effectiveness at an Air Force Base (Steel et al., 1982) using a quasi-experimental design called a Non-equivalent Control Group Design (Campbell & Stanley, 1963). Early results showed no significant differences between QCs and control

groups for job satisfaction, work group effectiveness, general organizational climate, and supervisory effectiveness. The following design limitations were encountered in this research: small sample size, weak treatment effects due to experimental mortality, failure of some circles to mature due to time constraints, and poor experimental control. While these factors adversely affected the study's validity and therefore, its findings, a valuable lesson learned was for future research to attempt to overcome these design limitations.

The amount of research on QC effectiveness available to date is only the "tip of the iceberg" in terms of the quantity needed to understand their effects and applications. The following quote from the AFIT research group paves the way for future QC research:

The scientific method is a slow, painstaking, and arduous process. We accumulate understanding about a given subject by conducting a number of studies in that area. No individual study can reveal the entire picture about a subject such as quality circle management. Our research will provide no definite conclusions about the value of quality circles. It will only begin the process of scientific inquiry into this topic. It is as if one piece of a very complex jigsaw puzzle were put in place. It represents a starting point and may provide some directions, but the picture is far from clear. Only after many studies have been conducted on various aspects of quality circles will the complete picture begin to take a definable shape (Steel et al., 1982, p. 43).

CHAPTER 2

METHOD

Sample Characteristics

Between the periods of December 1981 and February 1983, two Quality Circle interventions were conducted at two USAF installations--an operational flying base (Location A) and a large hospital (Location B). From these locations, two groups of predominantly military personnel with an average age of 20-25 years (Location A)/26-30 years (Location B) and an average length of service of 12-18 months in their organization comprised the initial total sample size of 582. Officers, enlisted personnel, and civilians participated in the study, with males composing the majority of the sample. The education level ranged from non-high school graduate to Master's Degree at each location. However, Location B had a higher education level overall.

The sample characteristics for the posttest data reflected higher means for each demographic characteristic. The only significant change was at Location B where females now predominated and the average time spent in the organization was between 24-36 months. In addition, the sample size for the posttest was 195 cases.

Measures

The four behavioral outcomes employed to evaluate the QC process were measured based on the participants' responses to items from a 133 question Survey of Work Attitudes developed at the Air Force Institute of Technology.

Job satisfaction. Job satisfaction was measured with the Minnesota Satisfaction Questionnaire (MSQ) which was subdivided into three facet satisfactions--extrinsic, intrinsic, and general. Twenty-one items (Appendix A) addressing extrinsic (items 5, 6, 12-14, and 19), intrinsic (items 1-4, 7-11, 15, 16, and 20), and general (all items) facets of job satisfaction were measured using a five-point Likert response scale (very dissatisfied--very satisfied). The reliability and validity of the MSQ have been extensively documented (e.g., Steel, 1982; Wanous & Lawler, 1972). However, Hulin and Waters (1971) found that care should be exercised in using multiple measures of job satisfaction in a regression analysis. Internal consistency reliabilities for these variables are given in Table 1.

Work group performance. Work group performance was measured using a seven-point Likert response scale (strongly disagree--strongly agree) for seven items (Appendix B) soliciting self-appraisals of job performance. Respondents rated their work group's performance in terms of output quantity and quality, decision making/problem solving ability, problem anticipation, problem adaptation, and resource

TABLE 1
Reliability Coefficients

Variable	Location A	Location B
Work Group Performance	.83	.86
Extrinsic Job Satisfaction	.72	.79
Intrinsic Job Satisfaction	.84	.85
General Job Satisfaction	.57	.63
Intent to Quit/Remain	.75	.75

utilization. Reliability data (Cronbach alpha) for this measure appear in Table 1.

Job effort. A measure of job effort was based on the respondents' self-perception of the typical effort expended in performance of their job (Appendix C). A five-point Likert scale (very little effort--very much effort) provided the response choices. Mitchell (1974) identified numerous studies on self-rating of job effort, and such measures typically demonstrated acceptable reliability and validity.

Intent to quit/remain. Intent to quit/remain was measured with two items (Appendix D), each using a separate five-point Likert response scale (within the coming year, if I have my own way I: definitely intend to remain--definitely intend to separate and all things considered, I really think that I will still be with the Air Force one year from now: strongly agree--strongly disagree) to determine future work plans. Kraut (1975) used a similar measure in his research on measuring intent to quit and found it quite successful in predicting short and long term employee turnover. Cronbach alpha reliability for this measure appears in Table 1.

All sample characteristics and demographic data are based on respondent's answers to background information questions from the survey (Appendix E).

Procedure

The research design approximates a nonequivalent control group design (Campbell & Stanley, 1963). The Survey of Work Attitudes, as the data collection medium, was administered to the two organizations in groups of approximately fifty people in an auditorium in December 1981--January 1982 (pretest) and again in January--February 1983 (posttest). Participants were briefed concerning their voluntary participation in the research effort and the anonymity of their survey responses. The survey also specified this and other administrative facts. After the pretest was administered, work groups were identified to receive the treatment condition (QC group). The remaining groups comprised the control group.

The Location A intervention focused on three squadrons--supply, civil engineering, and aircraft maintenance. A facilitator was selected for each squadron to administer the QC effort. Each unit had two QC groups (5-8 people per group). Training for QC group members was conducted one hour a week for ten weeks prior to the actual QC intervention. Unfortunately, the QC effort lost momentum and the groups dissolved. Two more units, the fire department and civilian personnel, were identified to attempt another QC intervention. A more concentrated training pattern (two half-day sessions) was tried in order to emphasize the QC program and motivate participants. However, the programs

at each unit also dissolved after a few meetings by the QC groups.

The Location B intervention involved numerous functional areas on the hospital staff--medical, nursing, laboratory, and administration. The project officer/facilitator had been trained in QC implementation at the DOD's QC course at Wright-Patterson AFB OH. In addition, a steering committee was established and a QC program charter was developed. QC training was conducted for the participants prior to implementation. However, like Location A, the effort had numerous problems. Chapter 4 provides a discussion of the problems encountered at both locations.

Analysis of Data

Several statistical procedures were used to conduct the data analysis. A correlation analysis was conducted among the variables using both pretest and posttest data to determine interdependency or strength of relationship between them. Mean difference tests (t-tests) were also conducted using pretest and posttest data between the Quality Circle groups and the control group at each location. These tests were conducted to determine statistical differences between the groups concerning demographic characteristics and the behavioral variables. Stepwise hierarchical regression analysis was the primary tool in analyzing the effects of QC participation on the variables. The posttest data were employed as the dependent variable. Pretest results

were entered on the first step of the regression analysis to eliminate criterion (dependent variable) variance attributable to pretest differences. A dummy variable representing the treatment condition (QC or control group member) was entered in step two of the analysis to identify significant \underline{R}^2 increases and therefore, unique criterion variance attributable to the QC intervention. This analysis was accomplished on each of the behavioral variables.

Due to the sample problems encountered, additional t-tests and regression analyses were conducted using data from the individuals who participated throughout the QC study's life. Although the sample size was relatively small, the uniformity in the composition of the two groups encouraged the results of this analysis to be examined.

CHAPTER 3

RESULTS

Introduction

This chapter consists of analysis and discussion of the study's results. Table 2 summarizes the sample composition at different stages in the study's development. All of the statistical methods used data resulting from those work groups which had more than two individuals participating at the time the posttest data were collected (QC work groups were included if they had at least one participant in the posttest). A combined data base was built by aggregating the data from all work groups meeting the posttest participation requirement. The resulting combined data base had sample sizes of 427 (pretest) and 186 (posttest).

Correlational Analysis

Table 3 depicts the intercorrelation matrix for the pretest data collapsed over locations. As expected, extrinsic measures of job satisfaction and intrinsic measures of job satisfaction have a very strong relationship (r values of .87 and .94, respectively) with general measures of job satisfaction. Extrinsic and intrinsic measures also show a relatively strong intercorrelation (.67), as does work group performance and general job

TABLE 2

Sample Size by Work Group and Wave of Data

Location A			Location B		
Work Group	Pretest	Posttest	Work Group	Pretest	Posttest
1*	62	39	1 @	9	2
2	17	40	2 @	7	-
3*	52	4	3*	8	2
4	64	11	4	10	3
5*@	14	-	5*	24	11
6 @	6	-	6	16	5
7*@	8	-	7	11	5
8 @	10	-	8	15	3
9*@	17	-	9 @	4	2
10 @	12	-	10 @	2	-
11*@	7	-	11	20	5
12 @	6	-	12	25	11
13*@	14	-	13*	9	5
14 @	9	-	14*	7	1
			15	22	4
			16*@	7	-
			17 @	1	-
			18	24	13
			19 @	2	1
			20	41	24
			21 @	12	2
			22 @	8	2
Total	298	94		284	101

Notes: * QC group

@ Work group excluded from statistical analyses

TABLE 3
Pretest Correlation Matrix

Variable	Work Group Performance	Job Effort	Extrinsic Job Satisfaction	Intrinsic Job Satisfaction	General Job Satisfaction
Work Group Performance					
Job Effort	.18				
Extrinsic Job Satisfaction	.46	.10			
Intrinsic Job Satisfaction	.42	.28	.67		
General Job Satisfaction	.50	.22	.87	.94	
Intent to Quit/Remain	.21	.28	.36	.37	.39

Notes: n = 422

With $n \geq 422$ a value of .10 is significant at $p < .05$

satisfaction (.50). Overall, all variables were significantly intercorrelated.

The intercorrelation matrix for the posttest data collapsed over locations is shown in Table 4. As observed in the pretest, the correlations between extrinsic and intrinsic measures of job satisfaction and general job satisfaction (.84 and .94, respectively) were considerable. However, several correlations were not significant in these results. Therefore, the pattern of interrelationship between variables varied across the survey administration.

Mean Difference Tests

Mean difference tests (t-tests) between the Quality Circle groups and the control group on selected demographic variables are displayed in Table 5. The combined data from both locations was used for this analysis. Several significant premeasure differences were detected between the treatment and control groups. Control group members appeared significantly better educated. However, they had performed less time in their current position and had spent considerably less time in their present occupation. Considerable leveling of the sample appears to have taken place prior to the posttest as the only significant difference in demographic characteristics at posttest was the control group members were significantly older. This leveling indicates a significant change occurred in the composition of the QC and control groups over the study's lifetime. Further

TABLE 4

Posttest Correlation Matrix

Variable	Work Group Performance	Job Effort	Extrinsic Job Satisfaction	Intrinsic Job Satisfaction	General Job Satisfaction
Work Group Performance					
Job Effort	.28				
Extrinsic Job Satisfaction	.34	.06			
Intrinsic Job Satisfaction	.37	.19	.62		
General Job Satisfaction	.41	.15	.84	.94	
Intent to Quit/Remain	.15	.07	.08	.09	.10

Notes: n = 183

TABLE 5

Quality Circles and Control Group Demographic Characteristics

Variable	Pretest (n=419)		Posttest (n=181)		t
	Quality Circle \bar{x}	Control Group \bar{x}	Quality Circle \bar{x}	Control Group \bar{x}	
Age	2.73	2.87	2.93	3.38	2.27**
Education Level	2.72	3.07	2.98	3.34	1.83
Months in Organization	4.37	4.55	5.11	5.61	1.79
Months in Present Position	4.02	3.56	4.39	4.39	-.02
Months in Present Occupation	5.32	4.52	5.36	5.47	.39
Pay Grade	2.71	2.46	2.89	2.82	-.34

Notes: * $p < .01$ ** $p < .05$

t-tests using the combined data were conducted to identify treatment condition differences on the behavioral variables. The results are depicted in Table 6. Work group performance was the only variable which produced a significant difference between the groups, and surprisingly, the control group was significantly higher on this variable after the QC implementation.

T-tests were also analyzed using the data from each location separately. Only work groups which met the post-test participation requirement were included in these analyses (see Table 2). The results for Location A are displayed in Table 7. Significant premeasure differences were detected between the treatment and control groups for all demographic variables. However, leveling of the sample took place as these differences did not appear on the post-test. This indicates a significant change took place in the composition of the QC and control groups at Location A over the length of the study.

Table 8 depicts the results of the t-tests conducted on Location A's behavioral variables. These figures show results similar to those using the combined data--work group performance was the only variable different between the groups and it was higher for the control group after the QC implementation.

Table 9 displays the demographic variable results for Location B. Significant premeasure differences were

TABLE 6

Quality Circles and Control Group Behavioral Variables

Variable	Pretest (n=426)			Posttest (n=184)		
	Quality Circle \bar{x}	Control Group \bar{x}	t	Quality Circle \bar{x}	Control Group \bar{x}	t
Work Group Performance	32.98	33.63	.76	35.15	38.10	2.67*
Job Effort	4.07	4.09	.21	4.30	4.32	.11
Extrinsic Job Satisfaction	17.34	17.57	.48	18.42	19.53	1.41
Intrinsic Job Satisfaction	43.47	43.26	-.26	45.10	46.58	1.08
General Job Satisfaction	67.70	67.60	-.07	70.27	73.55	1.53
Intent to Quit/Remain	11.47	11.59	.48	11.79	12.21	1.01

Notes: * $p < .01$ ** $p < .05$

TABLE 7

Quality Circles and Control Group Demographic Characteristics
Location A

Variable	Pretest (n=193)			Posttest (n=94)		
	Quality Circle \bar{x}	Control Group \bar{x}	t	Quality Circle \bar{x}	Control Group \bar{x}	t
Age	2.60	2.08	-3.36*	2.77	2.67	-.47
Education Level	2.60	2.32	-2.46**	2.91	2.80	-.49
Months in Organization	4.53	3.77	-2.82*	4.74	4.49	-.68
Months in Present Position	4.09	3.45	-2.56**	4.42	3.75	-1.89
Months in Present Occupation	5.23	3.99	-4.66*	5.07	4.90	-.42
Pay Grade	2.63	2.04	-3.27*	2.81	2.66	-.61

Notes: * $p < .01$ ** $p < .05$

TABLE 8
Quality Circles and Control Group Behavioral Variables
Location A

Variable	Pretest (n=197)			Posttest (n=93)		
	Quality Circle \bar{x}	Control Group \bar{x}	t	Quality Circle \bar{x}	Control Group \bar{x}	t
Work Group Performance	32.44	33.37	.78	34.05	37.04	2.33**
Job Effort	3.98	3.99	.04	4.26	4.14	-.53
Extrinsic Job Satisfaction	17.15	15.95	-1.75	18.16	18.52	.35
Intrinsic Job Satisfaction	42.71	40.84	-1.61	44.58	43.10	-.85
General Job Satisfaction	66.87	63.45	-1.88	69.70	68.55	-.44
Intent to Quit/Remain	11.18	10.68	-1.33	11.71	11.80	.16

Notes: * $p < .01$

** $p < .05$

TABLE 9

Quality Circles and Control Group Demographic Characteristics
Location B

Variable	Pretest (n=227)			Posttest (n=87)		
	Quality Circle \bar{x}	Control Group \bar{x}	t	Quality Circle \bar{x}	Control Group \bar{x}	t
Age	3.04	3.22	1.00	3.33	3.90	1.65
Education Level	3.02	3.40	2.01*	3.17	3.74	1.60
Months in Organization	4.11	4.88	2.50**	6.00	6.41	1.78
Months in Present Position	3.91	3.59	-1.06	4.33	4.84	1.08
Months in Present Occupation	5.55	4.78	-2.33**	6.06	5.88	-.44
Pay Grade	2.64	2.91	-1.53	3.15	2.95	-.53

Notes: * $p < .01$ ** $p < .05$

detected between the treatment group and the control group for these variables. The control group showed a higher education level, more time spent in the organization, and less time in their present occupation. However, leveling of the sample took place as these differences were not present on the posttest. As with Location A, this indicates a significant change occurred in the composition of the QC and control groups at Location B over the length of the study.

The t-test results for the behavioral variables are displayed in Table 10. These figures reflected no significant differences between the Quality Circle groups and the control group concerning their scores on either the pretest or posttest for the behavioral variables.

Regression Analysis

To avoid restrictive assumptions associated with analysis of covariance, the data were analyzed using stepwise hierarchical regression analysis (as described in Chapter 2, Analysis of Data Section) to determine the effect of QC participation on the behavioral variables. Pretest and posttest work group means for each of the behavioral variables were used in the regression analysis. A total of seventeen work groups met the posttest participation requirement of at least two individuals (one for QC groups) and therefore, a sample size of seventeen comprised the regression analysis. The results of the regression analysis

TABLE 10

Quality Circles and Control Group Behavioral Variables
Location B

Variable	Pretest (n=231)			Posttest (n=92)		
	Quality Circle \bar{x}	Control Group \bar{x}	t	Quality Circle \bar{x}	Control Group \bar{x}	t
Work Group Performance	33.96	33.85	-.08	37.58	38.87	.63
Job Effort	4.25	4.16	-.62	4.39	4.44	.21
Extrinsic Job Satisfaction	17.58	18.36	.92	19.00	20.24	.85
Intrinsic Job Satisfaction	44.21	44.76	.41	46.26	48.92	.96
General Job Satisfaction	68.31	70.01	.79	71.58	76.96	1.27
Intent to Quit/Remain	12.11	12.02	-.24	11.95	12.51	.86

Notes: * $p < .01$ ** $p < .05$

are displayed in Table 11. No significant changes in R^2 values for the introduction of the treatment variable (QC member) were statistically significant at the .05 level. Procedure New Regression was also run to clarify these findings. As before, the pretest results were entered on the first step for all behavioral variables. In each case the treatment condition failed to meet the entrance criterion level ($P_{IN}=.05$) and therefore, indicates no significant increment in criterion variance.

Location B (Matched Individuals) Data Analysis

T-tests were conducted on the results for individuals from Location B who participated throughout the entire QC evaluation. Table 12 depicts the demographic characteristics of this group. This data reflected significant differences at pretest measurement between QC groups and the control group regarding age and months in the organization. There were no significant differences at posttest measurement. An increase in the absolute values for months in organization, months in present position, and months in present occupation did occur, however. These variables may be expected to increase in a longitudinal study.

The results of the t-tests run on this data for the behavioral variables are displayed in Table 13. These figures reflected no significant differences between the treatment group and control group concerning their scores on the behavioral variables.

TABLE 11

Regression Analysis on Behavioral Variables

Variable	ΔR^2 for pretest introduction	ΔR^2 for treatment introduction	Total R^2	F value for treatment
Work Group Performance	.093	.063	.156	1.05
Job Effort	.056	.033	.089	.51
Extrinsic Job Satisfaction	.002	.193	.195	3.36
Intrinsic Job Satisfaction	.000	.166	.166	2.78
General Job Satisfaction	.000	.239	.239	4.39
Intent to Quit/Remain	.003	.093	.096	1.44

Notes: n = 17

TABLE 12

Quality Circles and Control Group Demographic Characteristics
Location B (Matched Individuals)

Variable	Pretest			Posttest		
	Quality Circle \bar{x}	Control Group \bar{x}	t	Quality Circle \bar{x}	Control Group \bar{x}	t
Age	3.10	3.75	2.13**	3.33	3.84	1.50
Education Level	3.00	3.38	1.37	3.17	3.70	1.53
Months in Organization	3.65	4.89	2.82*	6.00	6.26	1.09
Months in Present Position	3.75	3.54	-.45	4.33	4.70	.79
Months in Present Occupation	5.55	5.34	-.40	6.06	5.77	-.74
Pay Grade	3.11	2.78	-1.60	3.15	2.90	-.69

Notes: n = 100

* $p < .01$

** $p < .05$

TABLE 13

Quality Circles and Control Group Behavioral Variables
Location B (Matched Individuals)

Variable	Pretest		t	Posttest		t
	Quality Circle \bar{x}	Control Group \bar{x}		Quality Circle \bar{x}	Control Group \bar{x}	
Work Group Performance	33.95	35.37	.72	37.58	39.05	.72
Job Effort	4.35	4.26	-.34	4.39	4.39	-.01
Extrinsic Job Satisfaction	18.20	18.81	.49	19.00	20.09	.76
Intrinsic Job Satisfaction	43.85	46.30	1.10	46.26	48.72	.89
General Job Satisfaction	68.85	72.33	.98	71.58	76.54	1.18
Intent to Quit/Remain	12.47	12.88	.87	11.95	12.34	.61

Notes: n = 100

* $p < .01$

** $p < .05$

Regression analysis (Procedure New Regression) was conducted on these work group means (Table 13) and the results are displayed in Table 14. For all variables, the treatment condition failed to meet the entrance criterion level ($P_{IN}=.05$). Therefore, no significant increases in \underline{R}^2 were attributable to the treatment condition for the matched individual data.

TABLE 14
Regression Analysis on Behavioral Variables
Location B (Matched Individuals)

Variable	ΔR^2 for pretest Introduction	ΔR^2 for treatment introduction	Total R^2	F value of treatment
Work Group Performance	.103	.000	.103	.56
Job Effort	.024	.000	.024	.02
Extrinsic Job Satisfaction	.126	.000	.126	.49
Intrinsic Job Satisfaction	.102	.000	.102	.86
General Job Satisfaction	.083	.000	.083	1.46
Intent to Quit/Remain	.093	.000	.093	.07

Notes: n = 100

CHAPTER 4

DISCUSSION

Introduction

This chapter presents a discussion of the study's findings in reference to some problems encountered during the research. The author's conclusions and recommendations are then provided.

Findings

The results of this study indicate participation in a Quality Circle had no significant effect on the four behavioral outcomes studied--job satisfaction, work group performance, job effort, and intent to quit/remain. However, some methodological impairments confounded the study's results. The treatment groups were not equivalent at the outset of the study as significant differences between the groups on the demographic measures at the pretest were observed. Location A contributed to the majority of the nonequivalence of treatment groups as its groups reflected significant differences on all demographic variables measured. Statistical control (controlling for pretest differences) is a less than perfect control for preexisting differences between groups in a study as uncontrollable differences may interact with the treatment to produce uninterpretable

findings (Steel et al., 1982). Experimental mortality altered the character of samples in both treatment conditions. Changes in the composition of treatment groups occurred during the study as the sample size was reduced from 427 to 186. This reduction in sample size also could have limited the power of statistical tests to detect treatment effects since power is attenuated as sample size is decreased. In addition, some Quality Circles disbanded prior to collection of the postmeasure. As a result, their potential impact was never realized and reflected in the data. Some additional and associated problems were highlighted by the project officers at each location. The QC facilitator at Location A reported that employee turnover and a general lack of commitment by management and QC members towards QC implementation tended to hamper his efforts (Location A QC facilitator, 1983). Location B's facilitator highlighted numerous problem areas encountered at his location: assessing the organizational climate was cited as the most important element prior to QC implementation--in a hospital, several organizational climates exist simultaneously making QC efforts difficult; lack of top/middle management commitment was again cited--administration was the only area where management support was obtained; lack of worker enthusiasm for the voluntary QC effort was identified; and group mortality, as a result of shiftwork and job transition, was also encountered (Jackson & Morey, 1983).

The additional analysis on data collected from Location B's individuals who participated throughout the study was an attempt to overcome the effects of experimental mortality problems. However, it also was subject to non-equivalent treatment groups initially, small sample size, and the lack of management support problems that affected all study participants.

Conclusion

While the study's results did indicate Quality Circle participation had no effect on the behavioral variables studied, and indeed future research may support this finding, I feel this research effort provided valuable insight for future QC implementation and evaluation efforts. Even though the numerous confounding elements previously identified made the statistical results difficult to interpret, they were derived from a systematic and scientific evaluation process, and therefore, some valid observations can be made.

It is not unreasonable to conclude the study's results were accurate manifestations of the impact of an ineffectual QC intervention. The number of QC groups which broke-up after only a few meetings would support this observation. In addition, based on the information from the QC facilitators and the author's opinion, numerous problems were identified which, supported by the literature review, would suggest the potential for an unsuccessful QC

intervention at both locations. The mechanics of the QC implementation, key managerial issues, and cultural implications warrant further examination and are the focus of the following discussion.

Some fundamental concepts of a successful QC implementation appeared to have been taken lightly or ignored altogether. The lack of organizational readiness to accept a QC was a potential cause for their failure. Certainly, the multiple organizational climates encountered at Location B would support this issue as would the apprehension discovered in numerous participants at Location B. Closely related to this apprehension and its probable cause, was a lack of extensive training for QC members and a lack of knowledge by all organizational personnel concerning the QC intervention. As the literature revealed, the successful QC intervention is characterized by organizational assessment, training focused in two areas--statistical quality control and quality control methodology, and an understanding of the QC process by all personnel in the organization. Wood, Hull, and Azumi (1982) in their recent research on evaluating QCs found two-dimensional training to be the foundation of all QCs and the diffusion of the QC concept throughout the entire organization a critical factor for their success. Their quote, "A new program such as QCs may fail as a result of inherent flaws in the technique, from being introduced in the wrong context, or from poor

implementation" (p. 23) succinctly summarizes this problem area. It would now appear easy to hold the facilitator responsible for these shortcomings. However, his ability to perform is also a function of management's unconditional support.

The dramatic impacts of traditional American managerial styles and top management support on a QC intervention were detailed in the literature review. To paraphrase Hatvany and Pucik (1981), Alexander (1981), Ingle (1982), and Kanarick (1981), the crucial changes needed in America for successful QC implementation are improved management/employee communications and for management to show more respect for their employees' ability. Cole (1980) stated American managers had to adapt QCs to fit the needs of American management. However, this adaptation must be done cautiously in order to maintain the QC's purpose. Highlighting this potential pitfall, Wood et al., (1982) state:

. . . the American version has resulted in a relatively greater emphasis on group dynamics, human relations, and interpersonal communications. Some U.S. managers see the QCs primarily as a form of human relations which will lead to greater job commitment and higher productivity by workers. To the extent that American QCs are overly directed to productivity gains through better human relations and neglect statistical methods, disillusionment may occur (p. 5).

The issue of management support must also be reemphasized. The literature review identified eleven separate studies which cited management support, both top and middle, as critical to a successful QC intervention. The study's

results coupled with observations made by the facilitators can only reinforce this position.

Fortunately, these limiting conditions may be controlled if they are recognized. However, this recognition is often difficult because management actions are sometimes reflections of cultural traits.

Cultural traits impact the entire organization and their impact on QCs was also detailed in the literature review. Ten different research efforts discussed the American worker's individualism and lack of team oriented attitudes as they impacted the QC process. The implication of these and other cultural phenomenon is reflected in the following quote:

. . . they (American workers) may require greater amounts of training in interpersonal relations and group dynamics in order to make QCs work. The potential problem is that this American twist may result in an overemphasis on the human relations aspects, resulting in deemphasis of the quality control functions of QCs (Wood et al., 1982, p. 5-6).

Cole (1980) found the homogeneous nature of the Japanese culture critical to management's willingness to invest in the training of and providing responsibility to the worker. Dealing with the heterogeneous culture of the U.S. represents a formidable challenge for American managers. Unfortunately, there is no one absolute approach, but recognition of the impact of cultural phenomena will likely enhance the probability of a successful QC intervention.

Recommendations for Future Research

The following recommendations are based primarily on the study's conclusions and are intended to enhance the accurate assessment and effective implementation of a QC intervention. They are not presented in any rank order of importance and should be considered equally significant. The evidence appears clear--a weakness in any one of these areas can seriously degrade a QC program.

1. Select an aggressive, motivated, and respected (within organization) project officer/facilitator. His/her personality and behavior are critical to the establishment of a QC program--primarily as a QC advocate to gain management support, to generate enthusiasm among QC members, and to ensure the QC concept permeates the entire organization. His/her position should be a full-time responsibility.
2. Do not overstate the voluntary nature of the QC effort. Its voluntary status allows it to be overshadowed by the requirements of a daily schedule.
3. Ensure adequate training to all participants prior to starting any actual QC work. Both training aspects, statistical quality control and quality control methodology, must be emphasized.
4. Critically assess the organization's readiness to accept a QC intervention. Select an organization which is relatively stable in terms of performance and not subject to excessive turnover. A good performance record is

preferred as it would tend to reflect motivated personnel and an organization which could effectively handle an additional program. An organization with a relatively stable work force is necessary to overcome the methodological and statistical problems an altered and/or reduced sample presents. As cited earlier, this sample mortality problem has surfaced in other QC evaluation efforts and must be addressed. Evaluating management's ability and style is a critical part of this organizational assessment--is it conducive to a QC effort? It should be noted that, while an active USAF organization with all of these characteristics may be difficult to find, it is paramount to assessing QC effectiveness.

Finally, it is refreshing to note that the entire research effort to scientifically determine the value of Quality Circles is gaining momentum. During the year this research effort took place, more literature began to surface which reflected the empirical and rigorous characteristics desperately needed by the QC evaluation movement. Fortunately, I feel this study's goal was achieved. Paraphrasing Steel and his co-workers (1982), it is another piece of a very complex jigsaw puzzle and represents a small addition in the building of the scientific foundation with which the value of Quality Circles will someday accurately be assessed.

APPENDIX A
JOB SATISFACTION

How satisfied are you in your present job? Use the following rating scale to indicate your satisfaction.

1. Means you are very dissatisfied with this aspect of your job.
2. Means you are dissatisfied with this aspect.
3. Means you can't decide if you are satisfied or not with this aspect of your job.
4. Means you are satisfied with this aspect.
5. Means you are very satisfied with this aspect of your job.

1. Being able to keep busy all the time.
2. The chance to work alone on the job.
3. The chance to do different things from time to time.
4. The chance to be "somebody" in the community.
5. The way my boss handles his men.
6. The competence of my supervisor when he makes decisions.
7. Being able to do things that didn't go against my conscience.
8. The way my job provides for steady employment.
9. The chance to do things for other people.
10. The chance to tell people what to do.
11. The chance to do something that makes use of my abilities.
12. The way company policies are put into practice.
13. My pay and the amount of work I do.
14. The chances for advancement on the job.
15. The freedom to use my own judgement.
16. The chance to try my own methods of doing the job.
17. The working conditions.
18. The way my co-workers got along with one another.

19. The praise I get for doing a good job.
20. The feeling of accomplishment I got from the job.
21. Enjoying the work itself.

APPENDIX B
PERCEIVED WORK-GROUP PERFORMANCE

The following statements and questions deal with the performance of your work-group as you view it. Please think carefully of the things you and your work-group members produce by way of services and/or products as you respond to these questions. Use the following rating scale to indicate the extent to which you agree or disagree with the statements and questions shown below.

- 1 = strongly disagree
- 2 = moderately disagree
- 3 = slightly disagree
- 4 = neither agree or disagree
- 5 = slightly agree
- 6 = moderately agree
- 7 = strongly agree

1. The quantity of output of your work-group members is very high.
2. The quality of output of your work-group members is very high.
3. Your work-group members always get maximum output from the available resources (e.g., money, material, personnel).
4. Your work-group members do an excellent job anticipating problems that may come up and either preventing them from occurring or minimizing their effects.
5. When high priority work arises (e.g., "crash projects," and sudden schedule changes) your work-group members do an excellent job in handling and adapting to these situations.
6. My work-group is very effective in making decisions.
7. My work-group is very effective in the process of group problem solving (i.e., clearly defining/specifying the problem(s), developing and evaluating alternative solutions, and, selecting, implementing and evaluating a solution).

APPENDIX C
JOB EFFORT RATING

As fairly and objectively as you can, rate the typical amount of effort you normally put into doing your work.

- 1 = very little effort
- 2 = enough effort to get by
- 3 = moderate effort
- 4 = more effort than most
- 5 = very much effort

APPENDIX D
FUTURE WORK PLANS

Use the two rating scales given below to indicate your future work plans with respect to the Air Force.

1. Within the coming year, if I have my own way:

- 1 = I definitely intend to remain with the Air Force.
- 2 = I probably will remain with the Air Force.
- 3 = I have not decided whether I will remain with the Air Force.
- 4 = I probably will not remain with the Air Force.
- 5 = I definitely intend to separate from the Air Force.

2. All things considered, I really think that I will still be with the Air Force one year from now.

- 1 = strongly agree
- 2 = agree
- 3 = don't agree or disagree
- 4 = disagree
- 5 = strongly disagree

APPENDIX E
BACKGROUND INFORMATION

This section of the survey contains several items dealing with personal characteristics. This information will be used to obtain a picture of the background of the "typical employee."

1. Your age is:

1. Less than 20
2. 20 to 25
3. 26 to 30
4. 31 to 40
5. 41 to 50
6. 51 to 60
7. More than 60

2. Your highest educational level obtained was:

1. Non high school graduate
2. High school graduate or GED
3. Some college work
4. Associate degree or LPN
5. Bachelor's degree or RN
6. Some graduate work
7. Master's degree
8. Doctoral degree

3. Your sex is:

1. Male
2. Female

4. Total months in this organization is:

1. Less than 1 month
2. More than 1 month, less than 6 months
3. More than 6 months, less than 12 months
4. More than 12 months, less than 18 months
5. More than 18 months, less than 24 months
6. More than 24 months, less than 36 months
7. More than 36 months.

5. Total months in present position:

1. Less than 1 month
2. More than 1 month, less than 6 months
3. More than 6 months, less than 12 months
4. More than 12 months, less than 18 months
5. More than 18 months, less than 24 months
6. More than 24 months, less than 36 months
7. More than 36 months.

6. Total months experience in your present occupation:

1. Less than 1 month
2. More than 1 month, less than 6 months
3. More than 6 months, less than 12 months
4. Between 1 and 2 years
5. Between 2 and 3 years
6. Between 3 and 4 years
7. More than 4 years.

7. You are a (an):

1. Officer
2. Airman
3. Civilian (GS)
4. Civilian (WG)
5. Non-appropriated Fund (NAF employee)
6. Other

8. Your grade level is:

1. 1-2
2. 3-4
3. 5-6
4. 7-8
5. 9-10
6. 11-12
7. 13-14
8. Senior Executive Service

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